Factorising – Junior Cert Ordinary Level

Type of Factorising:	How Many Terms: (usually)	Example:
H.C.F. (Highest Common Factor)	2 Terms	$4ab + 12a$ $= 4a(b + 3)$
Grouping	4 Terms	$2bc + 4b + 3ac + 6a$ $= 2b(c + 2) + 3a(c + 2)$ $= (2b + 3a)(c + 2)$
Quadratic	3 Terms	$x^2 - 7x + 10$ $= (x - 5)(x - 2)$
D.O.T.S. (Difference of Two Squares)	2 Terms	$x^2 - 25$ $= x^2 - 5^2$ $= (x - 5)(x + 5)$

Highest Common Factor

Step 1: Find the HCF (this is the biggest number and letter which is common to both terms)	$3x^2 + 6x$ **(HCF = $3x$)**
Step 2: Put the HCF outside the brackets	$3x^2 + 6x$ $= 3x(\quad\quad)$
Step 3: Divide each term by the HCF to find the factor inside the brackets (What do I need to multiply by the HCF to get the first term? What do I need to multiply by the HCF to get the second term?)	$3x^2 + 6x$ $= 3x(x + 2)$

Grouping

Step 1: Separate the 4 terms into 2 pairs which have a common factor (this is usually done for you)	$3ac + 6c + ad + 2d$
Step 2: Do HCF for each pair (see above) (take out the common factor of each 2 terms) These brackets should be the same!	$3ac + 6c + ad + 2d$ $3c(a + 2) + d(a + 2)$
Step 3: Don't forget to put this into "Double Brackets" (This is actually like a giant HCF) (Put the two HCFs from the previous step into one bracket, and the second bracket is the one which was the same from the last step)	$3c(a + 2) + d(a + 2)$ $(3c + d)(a + 2)$

Quadratics – Trial and Error method

Step 1: Write down the question, and two empty brackets underneath	$x^2+5x-24$ $(\quad)(\quad)$
Step 2: Fill in the x and x as the first terms in the brackets *(because these will multiply together to give us the x^2 term)*	$x^2+5x-24$ $(x\quad)(x\quad)$
Step 3: We now need to think of two numbers that will multiply to make the last term. (You can write a list in some rough work if you like) Hint: if this is a + then both signs in the brackets will be the same. If it's a – sign then the signs will be different.	$x^2+5x-24$ Let's try -6 and 4 $(x-6)(x+4)$
Step 4: Multiply out the brackets (F.O.I.L.) Do the Outer and Inner terms add together to make the middle term of the original expression?	$x^2+5x-24$ $(x-6)(x+4)$ $x^2+\mathbf{4x}-\mathbf{6x}-24$ Is $4x-6x=5x$? NO! So - try again.
Step 5: Repeat steps 3 and 4 until you find 2 numbers that work!	$x^2+5x-24$ $(x+8)(x-3)$

DOTS (Difference of 2 Squares)

Step 1: Re-write the question as $(\boldsymbol{Something})^2-(\boldsymbol{Something\ else})^2$	x^2-36 $=(x)^2-(6)^2$
Step 2: Use the rule $\boldsymbol{a^2-b^2=(a+b)(a-b)}$ In words, this is (First + Second)(First – Second)	x^2-36 $=(x)^2-(6)^2$ $=(x+6)(x-6)$

FACTORISING QUADRATICS (TRIAL + ERROR METHOD)

FACTORISE : PUT IT INTO BRACKETS.

eg.

① $x^2 - 3x - 10$

② $(x - 5)(x + 2)$

⑤

③ IN THIS CASE, $x \times x = x^2$

④ IN THIS CASE, TRY 5 AND 2 BECAUSE $5 \times 2 = 10$.

STEP 1: WRITE DOWN THE QUADRATIC EXPRESSION
①

STEP 2: DRAW THE BRACKETS AND
②

STEP 3: WRITE DOWN THE 2 TERMS (USUALLY JUST x AND x) THAT MULTIPLY TO MAKE THE x^2 TERM OF THE QUADRATIC.
③

STEP 4: THINK OF 2 NUMBERS THAT MULTIPLY TO MAKE THE LAST TERM OF THE QUADRATIC.
④

STEP 5: WORK OUT THE SIGNS. (FOR THE LAST TERM)
⑤

REMEMBER !

SIGNS SAME	$+ \times +$ OR $- \times -$	$= +$
SIGNS DIFFERENT	$+ \times -$ OR $- \times +$	$= -$

STEP 6: MULTIPLY OUT THE BRACKETS TO CHECK IF YOU HAVE THE RIGHT ANSWER. IF YOU DON'T, GO BACK TO STEP ②.
⑥

eg $(x - 5)(x + 2)$ F.O.I.L.

⑥ $x^2 + 2x - 5x - 10$

$x^2 - 3x - 10$

THIS WAS THE QUADRATIC THAT WE STARTED WITH.. SO IT'S RIGHT

STEP 7: IF YOU HAVE THE RIGHT ANSWER, REMEMBER...

THE BRACKETS ARE THE ANSWER... NOT THE CHECKING...

$\boxed{\text{ANS: } (x - 5)(x + 2)}$

QUADRATIC EQUATIONS (EQUATIONS WITH AN x^2)

STEPS:
1. MAKE SURE EQUATION HAS AN "= 0"
2. FACTORISE
3. WRITE DOWN ANSWERS / SOLVE.

eg.

$$x^2 + 8x + 12 = 0$$

$$(x + 6)(x + 2) = 0$$

$$\boxed{x = -6} \quad \text{OR} \quad \boxed{x = -2}$$

THIS CAN BE LEARNT AS A RULE:
eg IF $(x - 2)$ IS A FACTOR, THEN $x = 2$ IS A "SOLUTION"
i.e. CHANGE THE SIGN

WHY??

eg

$$x^2 - 9x + 14 = 0$$

$$\underbrace{(x - 7)}_{\text{SOMETHING}} \times \underbrace{(x - 2)}_{\text{SOMETHING}} = 0$$

SOMETHING × SOMETHING.

$(x - 7)$ IS A NUMBER

$(x - 2)$ IS A NUMBER.

WHEN I MULTIPLY TWO NUMBERS TOGETHER TO MAKE ZERO, EITHER THE FIRST NUMBER OR THE SECOND NUMBER HAS TO BE $= 0$

SO, IN THIS EXAMPLE,

$$(x - 7)(x - 2) = 0$$

EITHER

$$x - \cancel{7} = 0$$
$$+\cancel{7} \quad +7$$
$$\boxed{x = 7}$$

OR

$$x - \cancel{2} = 0$$
$$+\cancel{2} \quad +2$$
$$\boxed{x = 2}$$

SOLVE